CLAIMS:

1. A method for controlling in a UWB receiver transitions between synchronization states that include an acquisition mode and a tracking mode, comprising the steps of:

identifying an in-band measure of a signal to noise ratio of an incoming UWB signal;

comparing the in-band measure of signal to noise ratio identified in the identifying step with an in-band signal to noise ratio threshold; and

transitioning between the acquisition mode and the tracking mode when in the comparing step it is determined that the in-band measure of signal to noise ratio has satisfied a predetermined criteria relative to in-band signal to noise ratio threshold.

2. The method of Claim1, wherein said identifying step includes calculating an estimate for an actual in-band measure of signal to noise ratio.

3. The method of Claim 1, wherein said transitioning step includes transitioning between modes each time it is determined in the comparing step that the in-band measure of signal to noise ratio has either surpassed, or dropped below the in-band signal to noise ratio threshold.

4. The method of claim 1, further comprising the step of:

setting a vector length of samples of the incoming UWB signal to a predetermined number so a transition between modes will occur while the UWB receiver is exhibiting a predetermined reception performance.

5. The method of Claim 4, wherein said predetermined reception performance being at least one of a predetermined amount of immunity to noise bursts and bit error rate.

6. The method of claim 1, wherein the transitioning step includes transitioning from said acquire mode to a predetermined number of alternative track states in said track mode.

7. The method of claim 6, wherein the predetermined number of alternative track states is based on a desired bit error rate to be achieved before a transition out of said tracking mode occurs.

8. A method for controlling in a UWB receiver transitions between synchronization states that include an acquisition mode and a tracking mode, comprising the steps of:

identifying at least two parameters that combine to form an indirect measure of a signal to noise ratio of an incoming UWB signal;

determining a control threshold parameter from a mathematical combination of the at least two parameters; and

transitioning between the acquisition mode and the tracking mode when the control threshold is set to a predetermined value.

9. The method of claim 8, wherein the identifying step identifies the at least two parameters as an indirect measure of an in-band signal to noise ratio of the incoming UWB signal.

10. The method of claim 8, wherein said at least two parameters includes:

$$m_1 = \left(\sum_{i=1}^{B} | x_i | \right)^2$$

as a first of said at least two parameters, where m_1 is an estimate of signal power and x_i is a stream of samples taken by the UWB receiver; and

$$s_1 = \sum_{i=1}^{B} x_i^2$$

as a second of said at least two parameters, where s_1 being a measure of noise power.

11. The method of claim 10, wherein:

said control parameter L is determined by

$$L = sign(m_1 - Ks_1),$$

where K is a constant.

12. The method of claim 8, wherein said at least two parameters includes:

$$l = \frac{1}{B}\sum_{i=1}^{B}|x_i|$$

as a first of said at least two parameters, where l^2 being an estimate of signal power, x_i being a stream of samples taken by the UWB receiver and B being a number of samples; and

$$g = \frac{1}{B}\sum_{i=1}^{B}|x_i|^2$$

as a second of said at least two parameters, where $g - l^2$ is an estimate of noise power.

13. The method of claim 12, wherein:

said control parameter L is determined by

$$L = \begin{cases} 1, for \frac{l^2}{g-l^2} \geq T_h \\ -1, for \frac{l^2}{g-l^2} < T_h \end{cases}$$

where T_h being a target level.

14. The method of claim 8, further comprising:

determining an estimate of noise power n_i during AGC initialization, wherein n_i being a first of said at least two parameters, and

A_i being a second of said at least two parameters and A_i being an estimate of an amplitude of the incoming signal.

15. The method of claim 14, wherein:

A_i being obtained from a subtraction of n_i from an absolute value of samples of the incoming UWB signal; and

said control parameter L being determined by

$$L = \begin{cases} 1, for \frac{l^2}{g-l^2} \geq T_h \\ -1, for \frac{l^2}{g-l^2} < T_h \end{cases}$$

where T_h being a target level.

16. The method of claim 8, further comprising the step of:

setting a number of samples of the incoming signal to a predetermined number so as to controllably establish a predetermined performance level with regard to when to control a change between the acquisition mode and the tracking mode.

17. The method of claim 8, wherein the identifying step further comprising the steps of:

computing a signal parameter related to signal power; and

computing a noise parameter related to noise power.

18. The method of claim 17, wherein the computing the signal parameter step further comprises the step of:

computing a sum of squares of absolute values of samples of the incoming signal over a predetermined number of samples.

19. The method of claim 17, wherein the computing the noise parameter step further comprising the step of:

computing a sum of samples of the incoming signal over a predetermined number of samples.

20. The method of claim 8, wherein the determining step further comprising the step of:

computing a sign of a difference between a signal parameter and a scaled noise parameter.

21. The method of claim 8, wherein the determining step further comprising the steps of:

computing a sum of absolute values of samples of the incoming signal over a predetermined number of samples; and

dividing the sum by the predetermined number of samples to obtain a first parameter of said at least two parameters.

22. The method of claim 8, wherein the determining step further comprising the steps of:

computing a sum of a square of absolute values of samples of the incoming signal over a predetermined number of samples; and

dividing the sum by the predetermined number of samples to obtain a second parameter of said at least two parameters.

23. The method of claim 8, wherein the transitioning step includes transitioning between a predetermined number of alternative track states.

24. The method of claim 8, wherein said step of identifying at least two parameters includes:

determining noise variance as a step in an automatic gain control initialization operation; and

identifying the noise variance determined in said determining step as one of said at least two parameters.

25. The method of claim 8, wherein said transitioning step includes transitioning between said acquisition mode and said tracking mode in a state machine, wherein said tracking mode being associated with a plurality of states so as to provide immunity to burst errors.

26. The method of claim 8, wherein said step of identifying includes representing respective of said at least two parameters with adjustable length vectors so as to enable an adjustable degree of mode control precision.

27. A method for switching between an acquisition mode and a tracking mode in a UWB receiver, comprising the steps of:

monitoring an amplitude of an incoming UWB signal;

determining a state parameter from the amplitude based on a noise variance of the incoming UWB signal determined during AGC initialization; and

controlling a transition from the acquisition mode to the tracking mode when the state parameter is set to a predetermined value.

28. The method of claim 27, wherein:

said monitoring step includes setting a number of samples of the incoming UWB signal to a predetermined value so as to controllably establish a predetermined degree of mode control precision.

29. The method of claim 27, wherein the controlling step includes transitioning from said acquisition mode to a predetermined number of alternative track states of said tracking mode.

30. The method of claim 29, wherein the predetermined number of alternative track states is based on a predetermined bit error rate.

31. The method of claim 29, wherein the predetermined number of alternative track states is based on a predetermined degree of immunity to burst errors for a synchronization process implemented in the UWB receiver.

32. A mode controller for switching between an acquisition mode and a tracking mode of a UWB receiver, comprising:

an acquire state machine configured to determine when an incoming UWB signal is acquired by said UWB receiver;

a track state machine configured to maintain synchronization with the incoming UWB signal after the UWB signal has been acquired in said acquire state machine; and

a control mechanism configured to control a transition between the acquire state machine and the track state machine when an in-band measure of signal to noise ratio satisfies a predetermined condition.

33. The mode controller of claim 31, wherein the track state machine comprises:

a processor configured to determine the in-band measure of the signal to noise ratio of the incoming UWB signal and calculate whether the in-band measure of signal to noise ratio satisfies a predetermined criteria that corresponds with a predetermined bit error rate.

34. The mode controller of claim 32, wherein:

the track state machine includes a predetermined number of tracking states, said predetermined number of tracking states corresponding with a degree of immunity to burst errors offered by the track state machine.

35. A controller configured to control when to switch between an acquisition mode and a tracking mode in a UWB receiver, comprising:

means for identifying an in-band measure of a signal to noise ratio of an incoming UWB signal;

means for comparing the in-band measure of signal to noise ratio with an in-band signal to noise ratio threshold; and

means for controlling a transition between the acquisition mode and the tracking mode when said means for comparing identifies that the in-band measure of signal to noise ratio has satisfied a predetermined criteria.

36. The controller of claim 35, further comprising:

means for setting a vector length of samples of the incoming UWB signal to a predetermined number so a transition between modes occurs with a predetermined performance accuracy.

37. The controller of Claim 36, wherein said predetermined performance accuracy is represented as at least one of a predetermined amount of immunity to noise bursts and bit error rate.

38. A controller configured to control when to switch between an acquisition mode and a tracking mode in a UWB receiver, comprising:

means for identifying at least two parameters that are an indirect measure of a signal to noise ratio of an incoming UWB signal;

means for determining a control threshold parameter L from a mathematical combination of the at least two parameters; and

means for transitioning between the acquisition mode and the tracking mode when the control threshold parameter L is set to a predetermined value by said means for determining.

39. The controller of claim 38, wherein the means for identifying includes:

means for identifying as a first of said at least two parameters,

$$m_1 = \left(\sum_{i=1}^{B} | x_i | \right)^2$$

where m_1 being an estimate of signal power and x_i being a stream of samples taken by the UWB receiver; and

means for identifying as a second of said at least two parameters,

$$s_1 = \sum_{i=1}^{B} x_i^2$$

where s_1 being a measure of noise power.

40. The controller of claim 39, wherein the means for identifying includes:

said control threshold parameter L being determined by

$L = sign(m_1 - Ks_1)$, where K being a constant.

41. The controller of claim 38, wherein said at least two parameters includes:

means for identifying as a first of said at least two parameters,

$$l = \frac{1}{B} \sum_{i=1}^{B} |x_i|$$

where l^2 being an estimate of signal power, x_i being a stream of samples taken by the UWB receiver and B being a number of samples; and

means for identifying as a second of said at least two parameters,

$$g = \frac{1}{B} \sum_{i=1}^{B} |x_i|^2$$

where $g -$ l^2 estimates noise power.

42. The controller of claim 41, wherein:

said means for determining determines the control parameter L by

$$L = \begin{cases} 1, for \frac{l^2}{g-l^2} \geq T_h \\ -1, for \frac{l^2}{g-l^2} < T_h \end{cases}$$

where T_h being a target level.

43. The controller of claim 38, further comprising:

means for setting a number of samples of the incoming signal to a predetermined number so as to controllably establish a predetermined performance level with regard to when to implement a change between the acquisition mode and the tracking mode.

44. The controller of claim 38, wherein the means for determining comprises:

means for computing a sum of absolute values of samples of the incoming signal over a predetermined number of samples; and

means for dividing the sum by the predetermined number of samples to obtain a first parameter of said at least two parameters.

45. The controller of claim 38, wherein the means for transitioning includes means for transitioning between a predetermined number of alternative track states.

46. The controller of claim 38, wherein said means for transitioning includes means for transitioning between states in a state machine, wherein said tracking mode being associated with a plurality of states so as to provide immunity against burst errors.

47. The controller of claim 38, wherein said means for identifying includes means for representing respective of said at least two parameters with adjustable length vectors so as to enable an adjustable degree of precision with which mode control is performed.

48. A controller configured to control when to switch between an acquisition mode and a tracking mode in a UWB receiver, comprising:

means for monitoring an amplitude of an incoming UWB signal;

means for determining a state parameter from the amplitude based on a noise variance of the incoming UWB signal determined during AGC initialization; and

mean for controlling a transition from the acquisition mode to the tracking mode when the state parameter is set to a predetermined value.

49. The controller of claim 48, wherein:

said means for monitoring includes means for setting a number of samples of the incoming UWB signal to a predetermined number so as to controllably establish a predetermined degree of precision with which the transition between modes is performed.

50. The controller of claim 48, wherein the means for controlling includes means for transitioning from said acquisition mode to a predetermined number of alternative track states of said tracking mode.

51. The method of claim 50, wherein the means for transitioning includes means for providing immunity to burst errors.

52. A mode controller for switching between an acquisition mode and a tracking mode of a UWB receiver, comprising:

means for determining when an incoming UWB signal is acquired by said UWB receiver;

means for maintaining synchronization with the incoming UWB signal after the UWB signal has been acquired in said means for determining;

means for estimating an in-band signal to noise ratio; and

means for controlling a transition between the acquire mode and the tracking mode when the estimate of signal to noise ratio satisfies a predetermined condition.

53. A UWB receiver configured to transition between an acquisition mode and a tracking mode, comprising:

an analog to digital converter configured to sample an incoming UWB signal;

a processor;

a computer program product having computer readable instructions that when executed by the processor perform steps of

identifying an in-band measure of a signal to noise ratio of an incoming UWB signal;

comparing the in-band measure of signal to noise ratio identified in the identifying step with an in-band signal to noise ratio threshold; and

transitioning between the acquisition mode and the tracking mode when in the comparing step it is determined that the in-band measure of signal to noise ratio has satisfied a predetermined criteria relative to in-band signal to noise ratio threshold.

54. The receiver of Claim 53, wherein said computer program product further comprising computer readable instructions that when executed by the processor implement the step of calculating a proxy for an actual signal to noise ratio.

55. The receiver of Claim 53, wherein said transitioning step includes transitioning each time it is determined in the comparing step that the in-band measure of signal to noise ratio has either surpassed, or dropped below the in-band signal to noise ratio threshold.

56. The receiver of claim 53, wherein said computer program product further comprising computer readable instructions that when executed by the processor implement the step of:

setting a vector length of samples of the incoming UWB signal to a predetermined number so a transition between modes will occur within a predetermined reception performance metric.

57. The receiver of Claim 56, wherein said predetermined reception performance metric being at least one of a predetermined amount of immunity to noise bursts and bit error rate.

58. The receiver of claim 57, wherein the predetermined number of alternative track states is based on bit error rate.

59. The method of claim 53, wherein the transitioning step includes transitioning from said acquisition mode to a predetermined number of alternative track states in said track mode.

60. A UWB receiver configured to transition between an acquisition mode and a tracking mode during synchronization operations, comprising:

an analog to digital converter configured to sample an incoming UWB signal;

a processor;

a computer program product having computer readable instructions that when executed by the processor perform steps of

identifying at least two parameters that are an indirect measure of a signal to noise ratio of an incoming UWB signal,

determining a control threshold parameter from a mathematical combination of the at least two parameters, and

transitioning between the acquisition mode and the tracking mode when the control threshold is set to a predetermined value in said determining step; and

a data detector configured to detect data included in the incoming UWB signal.

61. The receiver of claim 60, wherein the identifying step identifies the at least two parameters as an indirect measure of an in-band signal to noise ratio of the incoming UWB signal.

62. The receiver of claim 60, wherein said at least two parameters includes:

$$m_1 = \left(\sum_{i=1}^{B} | x_i | \right)^2$$

as a first of said at least two parameters, where m_1 being an estimate of signal power and x_i being a stream of samples taken by the UWB receiver; and

$$s_1 = \sum_{i=1}^{B} x_i^2$$

as a second of said at least two parameters, where s_1 being a measure of noise power.

63. The receiver of claim 62, wherein:

said control parameter L being determined by

$L = sign(m_1 - Ks_1)$, where K being a constant.

64. The receiver of claim 60, wherein said at least two parameters includes:

$$l = \frac{1}{B}\sum_{i=1}^{B}|x_i|$$

as a first of said at least two parameters, where l^2 being an estimate of signal power, x_i being a stream of samples taken by the UWB receiver and B being a number of samples; and

$$g = \frac{1}{B}\sum_{i=1}^{B}|x_i|^2$$

as a second of said at least two parameters, where $g - l^2$ estimates noise power.

65. The receiver of claim 64, wherein:

said control parameter L being determined by

$$L = \begin{cases} 1, for \frac{l^2}{g-l^2} \geq T_h \\ -1, for \frac{l^2}{g-l^2} < T_h \end{cases}$$

where T_h being a target level.

66. The receiver of claim 60, wherein:

said computer program product containing instructions that when executed by said processor perform a step of

determining an estimate of noise power n_i during AGC initialization, wherein

n_i being a first of said at least two parameters, and

A_i being a second of said at least two parameters and A_i being an estimate of an amplitude of the incoming signal.

67. The receiver of claim 66, wherein:

A_i being obtained from n_i being subtracted from an absolute value of the incoming UWB signal; and

said control parameter L being determined by

$$L = \begin{cases} 1, for \frac{l^2}{g-l^2} \geq T_h \\ -1, for \frac{l^2}{g-l^2} < T_h \end{cases}$$

where T_h being a target level.

68. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform a step of

setting a number of samples of the incoming signal to a predetermined number so as to controllably establish a predetermined performance level with regard to when to control a change between the acquisition mode and the tracking mode.

69. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform steps of:

computing a signal parameter related to signal power; and

computing a noise parameter related to noise power.

70. The receiver of claim 69, wherein said computer program product containing instructions that when executed by said processor perform a step of::

computing a sum of squares of absolute values of samples of the incoming signal over a predetermined number of samples.

71. The receiver of claim 69, wherein said computer program product containing instructions that when executed by said processor perform a step of:

computing a sum of samples of the incoming signal over a number of samples.

72. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform a step of:

computing a sign of a difference between a signal parameter and a scaled noise parameter.

73. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform steps of:

computing a sum of absolute values of samples of the incoming signal over a predetermined number of samples; and

dividing the sum by the predetermined number of samples to obtain a first parameter of said at least two parameters.

74. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform steps of:

computing a sum of a square of absolute values of samples of the incoming signal over a predetermined number of samples; and

dividing the sum by the predetermined number of samples to obtain a second parameter of said at least two parameters.

75. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform a step of transitioning between a predetermined number of alternative track states.

76. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform steps of:

determining noise variance as an initialization step in an automatic gain control operation; and

identifying the noise variance determined in said determining step as one of said at least two parameters.

77. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform a step of transitioning between said acquisition mode and said tracking mode in a state machine, wherein said tracking mode being associated with a plurality of states so as to provide immunity to burst errors.

78. The receiver of claim 60, wherein said computer program product containing instructions that when executed by said processor perform a step of representing respective of said at least two parameters with adjustable length vectors so as to enable a an adjustable degree of precision with which mode control is performed.

79. A UWB receiver configured to switch between an acquisition mode and a tracking mode during reception of an incoming UWB signal, comprising:

an analog to digital converter configured to sample the incoming UWB signal;

a processor;

a computer program product having computer readable instructions that when executed by the processor perform steps of

monitoring an amplitude of the incoming UWB signal,

determining a state parameter from the amplitude based on a noise variance of the incoming UWB signal determined during AGC initialization, and

controlling a transition from the acquisition mode to the tracking mode when the state parameter is set to a predetermined value; and

a data detector configured to detect data in the incoming UWB signal.

80. The receiver of claim 79, wherein said computer program product containing instructions that when executed by said processor perform a step of

setting a number of samples of the incoming UWB signal to a predetermined value so as to controllably establish a predetermined degree of precision with which said controlling step is performed.

81. The receiver of claim 80, wherein said computer program product containing instructions that when executed by said processor perform a step of transitioning from said acquisition mode to a predetermined number of alternative track states of said tracking mode.

82. The receiver of claim 81, wherein the predetermined number of alternative track states is based on a predetermined bit error rate.

83. The method of claim 81, wherein the predetermined number of alternative track states is based on a predetermined degree of immunity for a synchronization process executed in the UWB receiver to burst errors.

84. The controller of claim 38, further comprising:

means for determining an estimate of noise power n_i during AGC initialization, wherein

n_i being a first of said at least two parameters, and

A_i being a second of said at least two parameters and A_i being an estimate of an amplitude of the incoming UWB signal.